

## CARRIER-BASED ELECTRONIC MODULE

### ABSTRACT

An improved multi-chip module includes a circuit board having an array of electrical interconnection pads to which are mounted a plurality of IC package units. Each IC package unit includes multiple IC packages, which are mounted on opposite sides of a package carrier. The package units may be mounted on one or both sides of the circuit board. A variety of package carriers are used to create a number of different modules. One type of package carrier has a pair of major planar surfaces. Each planar surface incorporates electrical contact pads. At least one IC package is surface mounted on each major planar surface, by interconnecting the connection elements, or leads, of the package with the contact pads on the planar surface, to form the IC package unit. Another type of package carrier substrate has a multiple recesses for back-to-back surface mounting of the IC packages. The IC packages may be in contact with opposite sides of a heat sink layer embedded within the carrier substrate. Each resulting IC package unit is surface mounted to the circuit board. Still another type of package carrier combines features of the first two carriers. At least one of the packages is mounted on a planar surface of the carrier right-side up, while at least one other package is mounted on the carrier in a recess upside down. Two module types are shown using such a carrier. Any of the carriers may be equipped with its own set of interconnection leads or connection may be made directly between the leads of one package and the interconnection pads of the circuit board. Thin-film carriers may be employed in the construction of package modules, as may be ball-grid-array type packages.